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BACKGROUND OF THE INVENTION

The present invention relates to a device for sterilizing plastic and/or metal parts intended for stoppering ~~bottles.~~

~~The applicant has set itself the objective of producing a device~~ bottles which is less expensive than those currently used, and which is capable of ~~while at the same time~~ considerably extending the sterilization time duration. The present invention also relates to the production of ~~Another objective is to produce~~ a bottling plant that can be modified at will.

SUMMARY OF THE INVENTION

In accordance with ~~According to~~ the present invention, these objectives are achieved by providing ~~virtue of~~ a machine for sterilizing plastic and/or metal stoppering parts for bottles which is [[,]] ~~the machine being~~ installed on a bottling line, upstream of the screwing machine, and which operates ~~operating~~ at the same rate as that of the screwing machine. The ~~thereas, the~~ stoppering parts are [[being]] introduced unsterilized into an inlet at one end of the sterilizing machine and emerge ~~emerging~~ sterilized through an outlet at the other end of the sterilizing machine. The [[,]] ~~characterized in that the~~ path followed by the parts between the inlet and the outlet of the sterilizing

machine, and within the unit, [[it]] is a ~~spiral path.~~

~~The~~ helical path. The stoppering parts are set in motion by friction against a rotating member or by a driving ~~fluid.~~

~~A~~ fluid. The machine of ~~according to~~ the present invention carries out at least the functions of sterilizing and rinsing, [[;]] depending on the alternative embodiment used ~~form chosen~~, and [[it]] also carries out a pre-drying or drying function.

A ~~According to two~~ first alternative ~~forms of~~ embodiment of a sterilizing [[, a]] machine produced in accordance with ~~according to~~ the present invention comprises three successive and coaxial sections, including [[:]] sterilizing, rinsing and [[,]] drying sections. Each of [[,]] these sections has ~~having~~ the same axis as the helix ~~spiral~~ of the path for the stoppering parts, and the following ~~having the~~ preferred ~~and possible~~ characteristics [[below]].

The ~~As a preference, the~~ parts are preferably set in motion along [[in]] their path by friction against a rotating ~~member.~~

~~More~~ member. More particularly, the parts are set in motion by a conveying system formed of a hollow cylindrical sleeve which can rotate ~~move in rotation~~ around a helical ~~spiral~~ slideway which is secured to a stationary drum and which is wound around

the exterior wall of the drum. The ~~thereof, the~~ slideway has ~~having~~ a U-shaped profile which is ~~in the shape of a U~~ open toward the sleeve, and a height which is shorter than that of the stoppering parts, so that the friction between the rotary drum and the stoppering parts introduced into the slideway causes the [[said]] parts to move along the path.

In ~~As a preference, in~~ the sterilizing section, the bottom of the helical ~~spiral~~ screw preferably comprises a large number of ~~great many~~ holes through which a large number of ~~great many~~ nozzles, situated inside the stationary drum and preferably in its upper part, inject a sterilizing ~~solution.~~

~~As a preference, the~~ solution. The holes are preferably oriented ~~directed~~ in a direction which is inclined with respect to a radius of the drum.

The ~~As a preference, the~~ sterilizing liquid is preferably collected in the lower part of the stationary drum, in a suction cavity which is offset with respect to the vertical plane of symmetry of the drum. The [[, the]] liquid is then [[being]] offset by the rotation ~~rotating~~ of the rotary ~~drum.~~

~~As a preference, arrangements~~ drum. Arrangements are made to prevent the liquid from running over the ends of the drum.

Preferably, ~~As a preference, having been sucked up through a pipe,~~ the sterilizing liquid is drawn through a pipe, filtered in filtration means, [[then]] reheated by heating means, and then ~~recycled.~~

~~As a preference, transitions~~ recycled. Transitions between the several sections are preferably provided by arrangements of the helical ~~spiral slideway.~~

~~As a preference, the~~ slideway. The sterilizing solution is preferably injected by a nozzle into a pressure-equalizing chamber formed by a wall parallel to a wall [[that]] of the stationary ~~drum.~~

~~As a preference, a~~ drum. A groove is provided on the interior face of the rotary drum in which the central cap of the parts can slide ~~slides is provided on the interior face of the rotary drum~~.

Two ~~According to two~~ other alternative ~~forms of~~ embodiments of a sterilizing machine produced in accordance with ~~according to~~ the present invention set [[,]] the stoppering parts ~~are set~~ in motion using [[by]] a driving ~~fluid.~~

~~As a preference, the~~ fluid. The driving fluid is selected ~~chosen~~ from the group of fluids including [[(]] compressed air,

pulsed filtered air and [[,]] sterilizing liquid [[) set]].

The ~~As a preference, the~~ parts preferably travel in a conveying system which is formed of a hollow and stationary cylindrical sleeve surrounding a helical ~~spiral~~ slideway secured to a stationary drum and wound on the exterior wall of the drum. The ~~thereof, the~~ sole of the slideway has ~~having~~ openings for ~~injecting~~ the injection of driving ~~fluid.~~

~~As a preference, the~~ fluid. The slideway is preferably made by a profiled separation which is positioned and welded into a helical ~~spiral~~ groove made on the stationary ~~drum.~~

~~As a preference, the~~ drum. The sole is preferably a flexible metal strip which is wound between the separations and held by tension at its ends, [[and]] resting on two shoulders of the separation.

The sterilizing ~~As a preference, the~~ machine is preferably made of modules of identical design which are assembled in series and closed at both ~~ends.~~

~~As a preference, at~~ ends. At least one slit is preferably provided at the outlet of each module, and on its sleeve, to encourage the driving fluid to be sucked up into an annular ~~manifold.~~

~~As a preference, the~~ manifold. The liquid is preferably recycled into the inlet tube.

Depending on [[the]] need, the longitudinal axis of the machine is arranged vertically for vertical operation, or is arranged horizontally for horizontal operation.

In ~~According to~~ one of its [[the]] alternative forms, the machine comprises a standard module with several turns. The [[, the]] upper part of the last turn of the module [[which]] carries out a rinsing [[the]] function, ~~of rinsing~~ with air. The [[, the]] previous turns, or the front turns of the module, perform a ~~performing the~~ sterilizing function.

Preferably ~~As a preference~~, orifices for the passage of liquid-injection nozzles oriented at a driving angle are provided in the sole of each front ~~turn.~~

~~As a preference, one~~ turn. One of the orifices is preferably provided in the bottom part of each turn on the vertical plane of symmetry.

Preferably ~~As a preference~~, a cylinder is coaxial with the cylindrical sleeve and delimits a cylindrical discharge ~~space.~~

~~As a preference, the~~ space. The cylindrical sleeve

preferably has oblong-shaped discharge holes.

Preferably ~~As a preference~~, an air inlet inside the module distributes air to at least one air-injection nozzle for driving the stoppering parts. The air is [[,]] then distributed to at least a [[one]] second air-injection nozzle, which performs internal rinsing of the stoppering parts. The air is [[,]] then distributed to at least a [[one]] third air-injection nozzle, which performs external rinsing of the stoppering parts.

It is to be understood that the foregoing ~~Of course, the~~ preferred but non-limiting characteristics can ~~listed may~~ be applied individually or in ~~combination.~~

~~The~~ combination. The invention will be better understood with reference to ~~the aid of~~ the description which follows, together [[given]] with ~~reference to~~ the following drawings. ~~appended figures:~~

BRIEF DESCRIPTION OF THE DRAWINGS

[[-]] Figure 1 is a schematic [[:]] ~~a sketch showing, in~~ side view showing [[,]] a first alternative embodiment of the sterilizing machine of the present invention. [[,]]

[[-]] Figure 2 is a schematic view [[:]] ~~a sketch~~ showing the stationary drum and the conveying slideway. ~~for~~

~~conveying~~ [[,]]

[[-]] Figure 3 is a schematic view [[:]] ~~a sketch~~ showing the conveying assembly in vertical cross-section, taken in the sterilizing section. [[,]]

[[-]] Figure 4 is a [[: the]] detailed view of the conveying assembly, along [[in]] its upper part. [[,]]

[[-]] Figure 5 is a [[: the]] detailed view of the conveying assembly, along [[in]] its lower part. [[,]]

[[-]] Figure 6 is a schematic side view [[:]] ~~a sketch~~ showing [[,]] ~~in side view,~~ a second alternative embodiment of the sterilizing machine of the present invention. [[,]]

[[-]] Figure 7 is a schematic, sectional view [[:]] ~~a sketch~~ showing the stationary drum and the conveying slideway of the alternative ~~for conveying in the~~ embodiment shown in Figure ~~of figure~~ 6. [[,]]

[[-]] Figure 8 is a schematic view [[:]] ~~a sketch~~ showing the conveying assembly in vertical cross-section, taken in the sterilizing section. [[,]]

[[-]] Figure 9 is a [[: the]] detailed view of the conveying assembly shown in Figure 8, along [[in]] its upper part. [[,]]

[[-]] Figure 10 is a [[: the]] detailed view of the conveying assembly shown in Figure 8, along [[in]] its lower part. [[,]]

[[-]] Figure 11 is a cross-sectional [[, a]] view taken along

~~in section on~~ BB in Figure ~~of figure~~ 9. [[,]]

[[-]] Figures 12 to 18 are schematic views [[:]] ~~sketches~~ showing alternative ~~forms of~~ arrangements of the rotary drum. [[(6),]]

[[-]] Figures 19a and [[,]] 19b are schematic views [[:]] ~~sketches~~ showing alternative embodiment ~~the design of the~~ transitions between sections. [[,]]

[[-]] Figures 20a and [[,]] 20b are detailed views [[:]] ~~details~~ of the conveying assembly used for ~~in the case of~~ "sports stoppers". [[,]]

[[-]] Figure 21 is a schematic, sectional view [[:]] ~~a sketch~~ showing [[,]] ~~viewed in section,~~ a third alternative embodiment of the sterilizing machine of the present invention. [[,]]

[[-]] Figures 22, 22a and [[,]] 22b are [[:]] detailed views of the alternative embodiment shown in Figure 21. ~~of figure 2,~~

[[-]] Figure 23 schematically illustrates the [[:]] steps of [[in]] a method in accordance with ~~according to~~ the present invention. [[,]]

[[-]] Figures 24 and 25 are schematic [[:]] ~~skeleton~~ diagrams of a standard module used in ~~according to~~ a fourth alternative embodiment of the sterilizing machine of the present invention. [[,]]

[[-]] Figure 26 is [[:]] a schematic illustration ~~general arrangement~~ of a sterilizing plant comprising the

sterilizing machine shown in Figures ~~a device according to figures~~ 24 and 25. [[,]]

[[-]] Figure 27 is [[:]] a front view of the sterilizing plant shown in Figure ~~of figure~~ 26. [[,]]

[[-]] Figure 28 is [[:]] a detailed view of a sterilizing liquid injection nozzle. [[,]]

[[-]] Figure 29 is [[:]] a ~~view in~~ vertical cross-sectional view of one of the front turns of a standard sterilizing-rinsing module. [[,]]

[[-]] Figure 30 is a partial, cross-sectional view taken along [[:]] ~~a horizontal part section on~~ AA in Figure ~~of figure~~ 29. [[,]]

[[-]] Figure 31 is [[:]] a view, in vertical and transverse cross-section, of the upper part of the last turn of a standard sterilizing-rinsing module.

DETAILED DESCRIPTION OF THE INVENTION

Reference is [[made]] first made [[of all]] to Figures ~~figures~~ 1 to 5, which show ~~correspond to~~ a first alternative embodiment of the sterilizing device of the present invention.

The [[A]] sterilizing device (1) of ~~according to~~ the present invention is installed on a [[the]] bottling line, upstream of the screwing machine which is a conventional part of the bottling line, and operates at the same rate as that of the screwing

machine. The sterilizing ~~thereas.~~

~~Such a~~ device (1) essentially comprises three successive and coaxial sections including ~~along the same axis:~~ a sterilizing section (2), a rinsing section (3) and a drying zone (4).

Figures ~~In figures~~ 1 to 5 [[which]] show ~~depict~~ a first alternative ~~non limiting~~ embodiment of the sterilizing device (1) of the present invention, operating horizontally. The device (1) includes [[,]] ~~the invention is made up mainly of~~ a conveying assembly (5) formed of a hollow cylindrical sleeve (6) which can move in rotation around a helical ~~spiral~~ slideway (7). The slideway (7) is secured to ~~a stationary drum (8)~~ and wound around the exterior wall of a stationary drum (8) ~~thereof~~. The slideway (7) has a U-shaped profile which is ~~in the shape of a U~~ open toward the ~~sleeve.~~

~~The~~ sleeve (6). The sleeve or rotary drum (6) and the stationary drum (8) are coaxial.

An inclined straight part, forming an inlet slideway (9), extends from ~~The spiral slideway (7) is extended at~~ one end of the stationary drum (8). Unsterilized ~~by an inclined straight part forming an inlet slideway (9) in which all the unsterilized~~ stoppering parts (11) are all oriented in the same direction in the inlet slideway (9), and drop down toward the bottom to enter

the conveying ~~assembly.~~

~~The spiral slideway is extended at its~~ assembly. Another straight part, which is ~~other end by a straight part,~~ also inclined, extends from the other end of the stationary drum (8), forming an outlet slideway (10). The stoppering parts (11) are ~~so as to~~ directed downward, and are ~~the stoppering parts (11)~~ all oriented in the same direction as in the inlet slideway (9).

The slideway (7) is appreciably shorter in height (see Figures ~~figures~~ 9 and [[,]] 11) than the stoppering parts (11) [[so as]] to allow [[let]] them to protrude from the slideway (7). Friction ~~The friction~~ between the rotary drum (6) and the stoppering parts (11) causes the stoppering parts ~~latter~~ to move in the ~~spiral~~ slideway (7), driving them toward the exit slideway (10).

The interior surface of the rotary drum (6) can [[may]], for example, be smooth, [[or]] striated with grooves parallel to the axis of rotation, or striated with grooves in a helix formed ~~spiral~~ parallel to the axis (12) of the stationary ~~spiral~~ slideway (7) (see Figure ~~figure~~ 12).

The configuration of the ~~Thanks to this~~ internal conveying assembly (5) develops a [[, the]] path for the [[of a]] stoppering part (11) which is considerably lengthened in [[by]]

comparison to [[with]] the length of the stationary ~~drum.~~

~~By way of~~ drum (8). As an example, a stoppering part (11) will typically travel a length of ~~covers~~ 35 m for a sleeve length of 1 m.

In the sterilizing section (2) (see Figures ~~figures~~ 2 and 4), the bottom (13) of the helical ~~spiral~~ screw developed by the slideway (7) includes a large number of ~~comprises a great many~~ holes (14), and a large number of ~~through which a great many~~ nozzles (15) pass through the holes (14). The nozzles (15) are [[,]] situated inside the stationary drum (8), [[and]] preferably in its upper part, and inject a liquid, ~~and/or~~ gaseous and/or hot sterilizing ~~solution.~~

~~As a preference, the~~ solution. The holes (14) preferably are not directed radially, but are directed in an orientation ~~direction~~ which is inclined, for example, by an angle α = from 10 to 20°, with respect to a radius of the drum. In this way, [[The]] jets (16) of sterilizing solution can [[thus]] play a part in moving the stoppering parts (11).

As is shown ~~a preference, as~~ in Figure ~~figure~~ 5, the sterilizing liquid is preferably collected at the lower part of the stationary drum (8), in a suction cavity (17). The suction cavity (17) [[which]] is offset with respect to the vertical

plane of symmetry of the drum, and the liquid is [[being]] offset by rotation ~~the rotating~~ of the rotary drum (6).

Arrangements can be made to [[To]] prevent the liquid from running over the ends of the rotary ~~drum, arrangements are made, a few alternative forms of which are described hereinbelow by way of non limiting examples:~~

[[-]] ~~the~~ drum. As an example, the rotary drum (6) shown in Figures ~~(figures~~ 13, 14a and 14b [[)]] has ~~may have~~ rigid circular returns (18) at each end, the height of which exceeds the level (12) of liquid to be held back. In this embodiment [[case]], the inlet slideway (19) will need to be elbowed at (19) to pass around the return [[(18);]]

[[- if]] (18). As an alternative, the returns (18) shown in Figure 17 are made of an elastomer, or some other flexible material. A [[, a]] separating finger (21) can [[may]] be provided in line with the arrival of the inlet slideway ~~(9) (see figure 17);~~

[[- the]] (9). As another alternative, shown in Figure 15, the entire rotary drum (6) assembly can ~~(figure 15) may~~ be immersed in a tank [[(20);]]

[[- the]] (20). As another alternative, shown in Figure 16, the entire drum assembly can [[may]] be inclined and one of its ends can [[may]] be immersed in the

[[a]] tank ~~(20) (figure 16);~~

[[- the]] (20). As another alternative, shown in Figure 18, the radius of gyration of the ~~spiral~~ slideway (7) can [[may]] also be varied in line with the inlet and the outlet of the rotary drum (6) ~~(figure 18)~~.

The sterilizing liquid is first ~~Having been~~ sucked up by a pipe (18a) (see Figure ~~figure~~ 1). The [[, the]] sterilizing liquid is then filtered in filtration means (22), then reheated by heating means (23), and then recycled.

The rinsing section (3) and the drying section (4) ~~sections~~ each have a conveying assembly [[means]] constructed on the same principle as the conveying assembly (5) [[one]] in the sterilizing ~~section.~~

~~The transitions~~ section (2). Transitions between sections can [[may]] be accomplished by arrangements of the ~~spiral slideway:~~

[[- by]] slideway (7), for example, by varying the pitch diameter of the ~~spiral~~ slideway (7), which in this case is a one-piece construction (see ~~sketch at figure 19a);~~

[[- by]] Figure 19a), or by varying the pitch diameter and increasing the pitch (see Figure 19b), in order not to reduce the radius of gyration [[)]], in which [[this]]

case the slideway will be [[is]] visible ~~(see sketch at figure 19b)~~.

The supporting structures and the mechanical drive means shown (for example, the motor (30), the rollers (31), etc.) are known components within the competence of [[the]] persons skilled in the art.

Figures 6 to 11 show a [[A]] second alternative embodiment. The embodiment shown in Figures 6 to 11 essentially ~~is given by way of non limiting example in figures 6 to 11.~~

~~This one~~ differs from the [[first] embodiment shown in Figures 1 to 5 ~~essentially~~ in the form of the support structure (24), in [[and]] the transition between adjacent [[two]] sections, and by increasing the pitch of the ~~spiral slideway.~~

~~It~~ helical slideway. The embodiment shown in Figures 6 to 11 also includes ~~comprises~~ inspection hatches (25), which can ~~may of course~~ also be provided on the [[first]] embodiment shown in Figures 1 to 5.

Referring to Figure 9, the [[The]] sterilizing solution is injected by a nozzle (15) into a pressure-equalizing chamber (26) formed by a wall (27) which is located parallel to the inside surface [[that]] of the stationary drum (8). Figure 11, ~~(figure~~

~~9).~~

~~Figure 11 shows,~~ viewed in section along [[on]] BB in Figure ~~of figure~~ 9, shows stoppering parts in two successive loops of the ~~slideway.~~

~~These~~ slideway. Such embodiments can [[may]] be modified for sterilizing "sports" stoppers which have a central cap (29) projecting from the ~~lid.~~

~~In~~ lid. In this case [[,]] (figures 20a and 20b), straight grooves or channels parallel to the axis of rotation (28), and in which the central cap of the parts slides, are provided on the interior face of the rotary drum (6).

Reference is now made to Figures ~~figures~~ 21 to 23, which show [[of]] a third alternative embodiment of the sterilizing device of the present invention. Although this embodiment [[This]] is depicted operating vertically, from top to bottom, [[but]] the direction of operation could also be reversed, and provision could also be made for this embodiment ~~it to be made~~ to operate horizontally, in one direction or the other.

In the [[this] embodiment shown in Figures 21 to 23, the parts are set in motion by a driving fluid injected into the device. The ~~machine, their~~ path between the inlet E and the

outlet S of the device remains ~~machine remaining~~ a helical ~~spiral~~ path. The driving fluid is, for example, filtered air injected under pressure or blown in by a fan.

The stoppering parts travel in a conveying system (5) formed of a hollow and stationary cylindrical sleeve (101). The sleeve (101) is coaxial with a stationary drum (102), forming a support for a conveying helical ~~spiral~~ slideway (107) arranged in the space between the sleeve (101) and the drum ~~(102).~~

~~The~~ (102). The hollow cylindrical sleeve (101) surrounds a helical ~~spiral~~ slideway which is secured to a stationary drum and which is wound on the exterior wall of the drum. The ~~thereof, the~~ sole (103) of the slideway has ~~having~~ openings for injection of ~~injecting~~ the driving fluid.

As an ~~By way of a non limiting~~ example, Figures 21 and 22 show ~~the figures depict~~ a helical ~~spiral~~ slideway which is produced using a profiled separation (107a) positioned and welded into a helical ~~spiral~~ groove made on the exterior surface of the stationary drum (102) ~~(figure 22a).~~

~~The~~ (see Figure 22a). The bottom of the slideway, known as the sliding sole (103), is ~~made in the~~ formed of a flexible metal strip wound in a spiral between the separations (107a), and held by tension at its two ends. The [[, its]] two edges of the

sliding sole (103) rest ~~resting~~ on two shoulders (107b) provided on each side of the separation (107a) (see Figure ~~figure~~ 22a).

The resulting ~~As a preference, the~~ plant is preferably modular, as shown in Figures ~~figures~~ 21 and 22, meaning that ~~is to say that~~ the sterilizing section (108), the rinsing section (109) and the drying section (110) ~~sections~~ are modules of identical design. The modules are assembled in series by fastening means (104), and are closed at both ends by an inlet wall (111) and by an outlet wall ~~(111, 112).~~

~~Use is preferably made of a~~ (112). A single sliding sole is preferably used for all of the modules.

The [[These]] modules differ, according to their function, in terms of the fluid to be conveyed. Depending ~~therein.~~

~~Depending~~ on whether a module is used as a sterilizing section, as a washing section or as a drying section, tubes (106 or 106') internal to the drum (102) and parallel to the [[its]] longitudinal axis of the drum (102) deliver ~~bring in~~ sterilizing fluid or driving fluid (for example, delivering liquid through the tube (106) and delivering sterile air through the tube (106')).

The fluid is, for example, injected into a [[the]] pressure

chamber (105) by nozzles (114), the delivery of which can be adjusted by ~~virtue of~~ adjusting means (114b). The nozzles (114) ~~and which~~ pass through the drum (102) via rectangular slits (114a). From one to four nozzles per turn can [[may]] be provided (see Figures ~~figures~~ 21, 22, 22a and ~~22b).~~

~~The~~ 22b). The fluid then passes through the sliding sole through openings (113) ~~(the geometry of which is, for example, triangular (113a) or trapezoidal (113b) and known from the prior art)~~ which direct the jet of fluid in the direction of travel of the stoppering parts (see Figure ~~figure~~ 22a). The geometry of the openings (113), which is, for example, triangular (113a) or trapezoidal (113b), is per se known.

One (or more) suction slits (116) (see Figure ~~figure~~ 22a) [[,]] ~~preferably inclined (for example at 45°), is or~~ are provided at the outlet end of each module, on the ~~and on its~~ stationary sleeve (101), to encourage the driving fluid to be drawn ~~sucked up~~ into an annular manifold (115a) (see Figures ~~figures~~ 22a and 21) by ~~virtue of a~~ suction means (117). The suction slits (116) are preferably inclined, for example, at 45°. The withdrawn [[This]] fluid will then ~~go off to~~ be recycled in a fluid/air separator (119) (see Figure ~~figure~~ 21).

A hopper (120, 120') for collecting parasitic rejections of fluids inside the drums is provided at the outlet of each module

(see Figure ~~figure~~ 21). Such [[These]] rejections are carried away by concentric tubes (121, 121') to ~~as far as~~ a filter (122). The filter (122) [[which]] also collects [[the]] fluid leaving a tube (123) exiting from [[of]] the separator (119) ~~(figure 21).~~

~~The fluid~~ (see Figure 21). Fluid from the filter (122) is pumped by a recycling pump (124), and is taken to a reservoir (125). Fluid from the reservoir (125) is then recycled by an inlet pump (126) into the inlet tube (106).

A modular plant has many ~~advantages.~~

~~In particular, it~~ advantages, particularly the following. Modularity allows an existing plant to be modified, [[(]] for example, by adding modules if the sterilizing is insufficient. Modularity also [[), or]] makes it possible, using standard elements, to produce a plant tailored to local means. Modularity also [[, or]] allows a process to be carried out using the plant to be modified.

Figure 23 illustrates one of many examples of ~~depicts, by way of a non-limiting example,~~ the steps which can [[may]] make up a sterilizing method in accordance with ~~according to~~ the present invention. The illustrated steps include introducing the stoppering parts into the inlet (at E), injecting sterilizing liquid (liquid phase) (at A), injecting driving fluid (at B),

discharging (outlet) the sterilizing liquid (at C), injecting pure water (at D), injecting driving fluid (at H), discharging (outlet) the water (at F), drying the stoppering parts with air (at G), discharging (outlet) the air (at I), and discharging (outlet) the stoppering parts (at F). [[;]] ~~these are:~~

~~E: inlet of stoppering parts~~

~~A: injection of sterilizing liquid, liquid phase~~

~~B: injection of driving fluid~~

~~C: outlet of sterilizing liquid~~

~~D: injection of pure water~~

~~H: injection of driving fluid~~

~~F: outlet of water~~

~~G: drying with air~~

~~I: outlet of air~~

~~F: outlet of stoppering parts.~~

Reference is now made to Figures ~~figures~~ 24 to 30, which show [[of]] a fourth alternative embodiment of the sterilizing device of the present invention.

Figure 26 diagrammatically shows the installation of a sterilizing-rinsing device (201) produced in accordance with ~~according to~~ the present invention in a sterilizing plant (202) which is situated upstream of a bottling line ~~(203).~~

~~In~~ (203). In the plant (202), [[the]] stoppering parts (213) are delivered from a magazine (204) which orients [[them]] and distributes the stoppering parts (213). The stoppering parts (213) [[them,]] are then conveyed by an inlet slideway (214) to a sterilizing-rinsing device (201). The stoppering parts (213) ~~in which they~~ travel in the sterilizing-rinsing device (201) in a helical ~~spiral~~ path (215) under the effect of a driving fluid, and then leave the sterilizing-rinsing device (201) via an outlet slideway (216). The slideway (216) is fitted with a regulator (205) which determines ~~determining~~ the outlet speed of the stoppering parts (213) according to the rate needed for the bottling line (203). Also illustrated is [[,]] the casing of a charging machine (203a) and [[of]] a screwing machine (203b) ~~of which can be glimpsed~~.

Figures 26 and 27 show ~~depict~~ only the main components of the sterilizing liquid circuit, including the [[:]] reservoir (206), the pump (207), the filters (208), and the inlet (209) for introducing [[of]] liquid into the device (201). The inlet (209) splits ~~splitting~~ into a number of injection pipes (210), for example three, each supplying a liquid-injection nozzle (211a, 211b, ~~211c).~~

~~Of~~ 211c). For the compressed air circuit, only the locations of the air injection nozzles (212a, 212b) have been shown ~~depicted~~.

The [[A]] sterilizing-rinsing device (201) of the ~~according to this~~ fourth alternative embodiment which is schematically shown in Figures 24 and 26 is manufactured as ~~in the form of~~ a standard module that meets predetermined standard sterilization criteria. The helical [[,]] ~~said standard module being depicted schematically in figures 24 and 26.~~

~~The spiral~~ path of the illustrated standard module includes ~~comprises~~, as an [[for]] example, ~~although this is not limiting,~~ six contiguous turns. The [[, the]] upper part of the last turn (or rear turn) performs ~~of which carries out~~ the function of rinsing with air. The [[, the]] previous turns (or front turns) perform ~~performing~~ the sterilizing function using a sterilizing liquid injected through a number of liquid-injection nozzles, ~~of which there are~~ for example, three such nozzles (211a, 211b, 211c) per turn.

The U-shaped slideway which forms the helical ~~spiral~~ path (215) can [[may]] be produced by ~~according to~~ the techniques previously ~~already~~ described for the third ~~embodiment.~~

~~As~~ alternative embodiment. Also, as in the third alternative ~~previous~~ embodiment, the stoppering parts are conveyed through the standard module (201) between a stationary cylindrical sleeve (217) forming the outer envelope, a stationary sole (or bottom) (218) of the slideway, and two separating walls (219).

Within this path, the stoppering parts are set in motion by the sterilizing liquid, under pressure, which also acts as a driving ~~fluid.~~

~~For~~ fluid. For this, the nozzles are distributed uniformly over each turn and are oriented at a driving angle (ß) (see Figure 29). The driving angle (ß) shown in Figure ~~as shown by figure~~ 29, which corresponds to a detailed view of one of the front ~~turns.~~

~~The driving angle (ß)~~ turns, is preferably measured tangentially to the sole of the turns.

Orifices (220a, 220b, 220c) are provided in the soles of the turns, for [[the]] passage of the nozzles (211a, 211b, ~~211c).~~

~~As a preference, one~~ 211c). One of the orifices (220c) is preferably provided in the bottom part of each turn, on the vertical and longitudinal plane (221) of the ~~module.~~

~~A~~ module. A cylinder (222a) which is coaxial with the cylindrical stationary sleeve (217) defines ~~delimits~~, together with the ~~collection of the~~ bottoms of the turns (218), a cylindrical discharge space (222).

Excess sterilizing liquid is discharged through the two

upper orifices (220a, 220b) of each turn. The discharged liquid [[,]] flows into the cylindrical space (222), passes through the bottom orifices (220c) of the front turns, and then through the discharge holes (223) provided in the bottom of the outer cylindrical sleeve (217). The discharged liquid is [[to]] then [[be]] collected in a discharge tank (225).

The discharge holes (223) (see Figure ~~figure~~ 30) are preferably oblong in shape, with their longitudinal axis being placed at right angles to the vertical longitudinal plane (221) of the module and on the axes of the separations (219). In this way, ~~so that~~ the liquid is discharged through the more or less triangular gaps (224) which lie on each side of the separations (219) of the slideway between the stoppering parts (213).

Reference is now made to Figure ~~figure~~ 31, which shows the rinsing with air which is performed more or less in one half or one third of the upper part of the last ~~turn.~~

~~An~~ turn. An inlet (223) for [[of]] pressurized air is ~~(223),~~ situated inside the module (201). The inlet (223) [[,]] distributes air under pressure to a first ~~(or several)~~ air-injection nozzle ~~nozzle(s)~~ (212a) (or to several air-injection nozzles) which discharges ~~directing~~ the air in the direction in which the stoppering parts (213) move. This operates [[so as]] to assume the function of a ~~take-over, by way~~

~~of~~ driving fluid, which function was performed by [[from]] the sterilizing liquid ~~which performs this function~~ in the bottom part of the turn, and which has been ~~discharged.~~

~~The~~ discharged. The air inlet (223) also distributes air to a second ~~(or several)~~ air-injection nozzle ~~nozzle(s)~~ (212b) (or to several air-injection nozzles) which is situated toward the top of the last turn. The nozzle (212b) directs ~~and directing~~ air toward the inside of the stoppering parts which travel past the nozzle (212b), rinsing the ~~it so as to rinse their~~ insides of the stoppering parts (213), one after the ~~other.~~

~~The~~ other. The outsides of the stoppering parts (213) are rinsed by one or more nozzles (212c) situated externally to the cylindrical sleeve (217).

In the upper part of the last turn performing such rinsing, the stoppering parts (213) are driven by [[the]] air, and then rinsed on the inside and on the outside (or vice versa). In this way, the stoppering parts (213) [[to]] arrive partially ~~already partly~~ dried in the outlet slideway. From the outlet slideway, the already partially dried stoppering parts (213) are directed ~~which directs them~~ toward a dryer (not shown ~~depicted~~) which will complete the drying of the stoppering parts (213). In ~~thereof.~~

~~In~~ order to regulate the exit speed of the stoppering parts

(213), the regulator (205) can [[may]], for example, be ~~made up of~~ a star-shaped rotary component (226) which is driven by a geared motor (227).